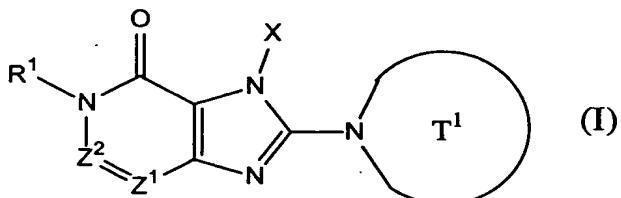


## CLAIMS

1. A compound represented by the following formula, or a salt or hydrate thereof,

5



wherein,

10  $T^1$  represents a monocyclic or bicyclic 4- to 12-membered heterocyclic group containing one or two nitrogen atoms in the ring, that may have one or more substituents;

15  $X$  represents a  $C_{1-6}$  alkyl group which may have one or more substituents, a  $C_{2-6}$  alkenyl group which may have one or more substituents, a  $C_{2-6}$  alkynyl group which may have one or more substituents, a  $C_{6-10}$  aryl group which may have one or more substituents, a 5 to 10-membered heteroaryl group which may have one or more substituents, a  $C_{6-10}$  aryl  $C_{1-6}$  alkyl group which may have one or more substituents, or a 5 to 10-membered heteroaryl  $C_{1-6}$  alkyl group which may have one or more substituents;

20  $Z^1$  and  $Z^2$  each independently represent a nitrogen atom or a group represented by the formula  $-CR^2=$ ;

25  $R^1$  and  $R^2$  each independently represent a group according to the formula  $-A^0-A^1-A^2$

(wherein  $A^0$  represents a single bond or a  $C_{1-6}$  alkylene group which may have 1 to 3 substituents selected from group B consisting of the substituents described below;

30  $A^1$  represents a single bond, an oxygen atom, a sulfur atom, a sulfinyl group, a sulfonyl group, a carbonyl group, a

group represented by the formula  $-O-CO-$ , a group represented by the formula  $-CO-O-$ , a group represented by the formula  $-NR^A-$ , a group represented by the formula  $-CO-NR^A-$ , a group represented by the formula  $-NR^A-CO-$ , a group represented by the formula  $-SO_2-NR^A-$ , or a group represented by the formula  $-NR^A-SO_2-$ ;  
 5  $A^2$  and  $R^A$  each independently represent a hydrogen atom, a halogen atom, a cyano group, a  $C_{1-6}$  alkyl group, a  $C_{3-8}$  cycloalkyl group, a  $C_{2-6}$  alkenyl group, a  $C_{2-6}$  alkynyl group,  $C_{6-10}$  aryl group, a 5 to 10-membered heteroaryl group, a 4 to 8-membered heterocyclic group, a 5 to 10-membered heteroaryl  $C_{1-6}$  alkyl group, a  $C_{6-10}$  aryl  $C_{1-6}$  alkyl group, or a  $C_{2-7}$  alkylcarbonyl group;  
 10 however,  $A^2$  and  $R^A$  each independently may have 1 to 3 substituents selected from the substituent group B described below:

when  $Z^2$  is a group represented by the formula  $-CR^2=$ ,  $R^1$ , and  $R^2$  may in combination form a 5 to 7-membered ring;

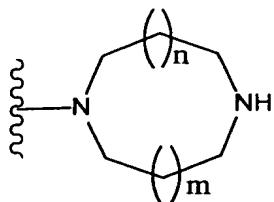
20 except in cases where: [1]  $R^1$  is a hydrogen atom;  $Z^1$  is a nitrogen atom; and  $Z^2$  is  $-CH=$ ; and [2]  $Z^1$  is a nitrogen atom; and  $Z^2$  is  $-C(OH)=$ ;

25 <Substituent group B>

Substituent group B represents the group consisting of: a hydroxyl group, a mercapto group, a cyano group, a nitro group, a halogen atom, a trifluoromethyl group, a  $C_{1-6}$  alkyl group which may have one or more substituents, a  $C_{3-8}$  cycloalkyl group, a  $C_{2-6}$  alkenyl group, a  $C_{2-6}$  alkynyl group, a  $C_{6-10}$  aryl group, a 5 to 10-membered heteroaryl group, a 4 to 8-membered heterocyclic group, a  $C_{1-6}$  alkoxy group, a  $C_{1-6}$  alkylthio group, a group represented by the formula  $-SO_2-NR^{B1}-R^{B2}$ , a group represented by the formula  $-NR^{B1}-CO-R^{B2}$ , a group represented by the formula  $-NR^{B1}-R^{B2}$  (where  $R^{B1}$  and  $R^{B2}$  each independently represent a hydrogen atom or a  $C_{1-6}$

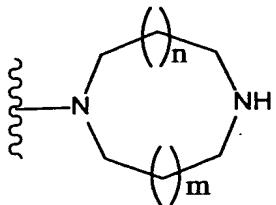
alkyl group), a group represented by the formula  $-\text{CO}-\text{R}^{\text{B}3}$  (where  $\text{R}^{\text{B}3}$  represents a 4 to 8-membered heterocyclic group), a group represented by the formula  $-\text{CO}-\text{R}^{\text{B}4}-\text{R}^{\text{B}5}$  and a group represented by the formula  $-\text{CH}_2-\text{CO}-\text{R}^{\text{B}4}-\text{R}^{\text{B}5}$  (where  $\text{R}^{\text{B}4}$  represents a single bond, an oxygen atom, or a group represented by the formula  $-\text{NR}^{\text{B}6}-$ ;  $\text{R}^{\text{B}5}$  and  $\text{R}^{\text{B}6}$  each independently represent a hydrogen atom, a  $\text{C}_{1-6}$  alkyl group, a  $\text{C}_{3-8}$  cycloalkyl group, a  $\text{C}_{2-6}$  alkenyl group, a  $\text{C}_{2-6}$  alkynyl group, a  $\text{C}_{6-10}$  aryl group, a 5 to 10-membered heteroaryl group, a 4 to 8-membered heterocyclic  $\text{C}_{1-6}$  alkyl group, a  $\text{C}_{6-10}$  aryl  $\text{C}_{1-6}$  alkyl group, or a 5 to 10-membered heteroaryl  $\text{C}_{1-6}$  alkyl group)).

2. The compound according to claim 1, or a salt or hydrate thereof, wherein  $\text{T}^1$  is, a group represented by the following formula:



(wherein,  $n$  and  $m$  each independently represent 0 or 1) which may have one or more substituents; an azetidin-1-yl group which may have one or more substituents; a pyrrolidin-1-yl group which may have one or more substituents; a piperidin-1-yl group which may have one or more substituents; or an azepan-1-yl group which may have one or more substituents.

3. The compound according to claim 1, or a salt or hydrate thereof, wherein  $\text{T}^1$  is, a group represented by the following formula :



(where  $n$  and  $m$  each independently represent 0 or 1);

an azetidin-1-yl group which may have an amino group;

5 a pyrrolidin-1-yl group which may have an amino group;

a piperidin-1-yl group which may have an amino group; or

an azepan-1-yl group which may have an amino group.

4. The compound according to claim 1, or a salt or hydrate thereof,

10 wherein  $T^1$  is a piperazin-1-yl group or a 3-aminopiperidin-1-yl group.

5. The compound according to claim 1, or a salt or hydrate thereof, wherein  $T^1$  is a piperazin-1-yl group.

15 6. The compound according to any one of claims 1 to 5, or a salt or hydrate thereof, wherein  $X$  is a group represented by the formula  $-X^1-X^2$  (where  $X^1$  represents a single bond or a methylene group which may have one or more substituents;  $X^2$  represents a  $C_{2-6}$  alkenyl group which may have one or 20 more substituents, a  $C_{2-6}$  alkynyl group may have one or more substituents, or a phenyl group which may have one or more substituents).

25 7. The compound according to any one of claims 1 to 5, or a salt or hydrate thereof, wherein  $X$  is a group represented by the formula  $-X^{11}-X^{12}$  (where  $X^{11}$  represents a single bond or a methylene group;  $X^{12}$  represents a  $C_{2-6}$  alkenyl group, a  $C_{2-6}$  alkynyl group, or a phenyl group which may have one or more substituents).

30 8. The compound according to claim 6 or 7, or a salt or hydrate thereof, wherein the phenyl group that may have one or more substituents is a phenyl group which may have at the 2-position a substituent selected from the group consisting of a hydroxyl group, a fluorine atom, a

chlorine atom, a methyl group, an ethyl group, a fluoromethyl group, a vinyl group, a methoxy group, an ethoxy group, an acetyl group, a cyano group, a formyl group, and a C<sub>2-7</sub> alkoxy carbonyl group.

5 9. The compound according to any one of claims 1 to 5, or a salt or  
hydrate thereof, wherein X is a 3-methyl-2-buten-1-yl group, a  
2-butyn-1-yl group, a benzyl group, or a 2-chlorophenyl group.

10 10. The compound according to any one of claims 1 to 5, or a salt  
or hydrate thereof, wherein X is a 2-butyn-1-yl group.

11. The compound according to any one of claims 1 to 10, or a salt  
or hydrate thereof, wherein either the Z<sup>1</sup> or Z<sup>2</sup> is a nitrogen atom.

15 12. The compound according to any one of claims 1 to 10, or a salt  
or hydrate thereof, wherein,  
Z<sup>1</sup> is a nitrogen atom; and  
Z<sup>2</sup> is a group represented by the formula -CR<sup>2</sup>=  
(where R<sup>2</sup> is as defined above in claim 1).

20 13. The compound according to any one of claims 1 to 10, or a salt  
or a hydrate thereof, wherein,  
Z<sup>2</sup> is a nitrogen atom; and  
Z<sup>1</sup> is a group represented by the formula -CR<sup>2</sup>=  
(where R<sup>2</sup> is as defined above in claim 1).

25 14. The compound according to any one of claims 1 to 13, or a salt  
or hydrate thereof,  
wherein R<sup>1</sup> represents a hydrogen atom, or a group represented by the  
30 formula -A<sup>10</sup>-A<sup>11</sup>-A<sup>12</sup>  
(where A<sup>10</sup> represents a C<sub>1-6</sub> alkylene group which may have 1 to  
3 substituents selected from the substituent group C described  
below;  
A<sup>11</sup> represents a single bond, an oxygen atom, a sulfur atom or  
35 a carbonyl group;  
A<sup>12</sup> represents a hydrogen atom, a C<sub>6-10</sub> aryl group which may have

1 to 3 substituents selected from the substituent group C described below, a 5 to 10-membered heteroaryl group which may have 1 to 3 substituents selected from the substituent group C described below, a 5 to 10-membered heteroaryl C<sub>1-6</sub> alkyl group which may have 1 to 3 substituents selected from the substituent group C described below, or a C<sub>6-10</sub> aryl C<sub>1-6</sub> alkyl group which may have 1 to 3 substituents selected from the substituent group C described below:

10 <Substituent group C>

Substituent group C represents the group consisting of: a hydroxyl group, a nitro group, a cyano group, a halogen atom, a C<sub>1-6</sub> alkyl group, a C<sub>1-6</sub> alkoxy group, a C<sub>1-6</sub> alkylthio group, a trifluoromethyl group, a group represented by the formula -NR<sup>C1</sup>-R<sup>C2</sup> (where each of R<sup>C1</sup> and R<sup>C2</sup> independently represent a hydrogen atom or C<sub>1-6</sub> alkyl group), a group represented by the formula -CO-R<sup>C3</sup>-R<sup>C4</sup> and a group represented by the formula -CH<sub>2</sub>-CO-R<sup>C3</sup>-R<sup>C4</sup> (where R<sup>C3</sup> represents a single bond, an oxygen atom, or a group represented by the formula -NR<sup>C5</sup>-; R<sup>C4</sup> and R<sup>C5</sup> each independently represent a hydrogen atom or a C<sub>1-6</sub> alkyl group).

15. The compound according to any one of claims 1 to 13, or a salt or hydrate thereof,

20 wherein R<sup>1</sup> is a hydrogen atom, a C<sub>1-6</sub> alkyl group which may have 1 to 3 substituents selected from the substituent group C described below, a 5 to 10-membered heteroaryl C<sub>1-6</sub> alkyl group which may have 1 to 3 substituents selected from the substituent group C described below, or a C<sub>6-10</sub> aryl C<sub>1-6</sub> alkyl group which may have 1 to 3 substituents selected from the substituent group C described below:

25 <Substituent group C>

Substituent group C represents the group consisting of: a hydroxyl group, a nitro group, a cyano group, a halogen atom, a C<sub>1-6</sub> alkyl group, a C<sub>1-6</sub> alkoxy group, a C<sub>1-6</sub> alkylthio group, a trifluoromethyl group, a group represented by the formula -NR<sup>C1</sup>-R<sup>C2</sup> (where each of R<sup>C1</sup> and R<sup>C2</sup> independently represent a

hydrogen atom or a C<sub>1-6</sub> alkyl group), a group represented by the formula -CO-R<sup>C3</sup>-R<sup>C4</sup> and a group represented by the formula -CH<sub>2</sub>-CO-R<sup>C3</sup>-R<sup>C4</sup> (where R<sup>C3</sup> represents a single bond, an oxygen atom, or a group represented by the formula -NR<sup>C5</sup>-; R<sup>C4</sup> and R<sup>C5</sup> each independently represent a hydrogen atom or a C<sub>1-6</sub> alkyl group);

5       16. The compound according to claim 14 or 15, or a salt or hydrate thereof, wherein the substituent group C is a group consisting of a cyano group, a C<sub>1-6</sub> alkoxy group, a C<sub>2-7</sub> alkoxy carbonyl group, and a halogen atom.

10       17. The compound according to any one of claims 1 to 13, or a salt or hydrate thereof, wherein R<sup>1</sup> is a methyl group, a cyanobenzyl group, a fluorocyanobenzyl group, a phenethyl group, a 2-methoxyethyl group, or a 4-methoxycarbonylpyridin-2-yl group.

15       18. The compound according to any one of claims 1 to 13, or a salt or hydrate thereof, wherein R<sup>1</sup> is a methyl group or a 2-cyanobenzyl group.

20       19. The compound according to any one of claims 1 to 18, or a salt or hydrate thereof,  
wherein R<sup>2</sup> is a hydrogen atom, a cyano group, or a group represented by the formula -A<sup>21</sup>-A<sup>22</sup>

25       (where A<sup>21</sup> represents a single bond, an oxygen atom, a sulfur atom, a sulfinyl group, a sulfonyl group, a carbonyl group, a group represented by the formula -O-CO-, a group represented by the formula -CO-O-, a group represented by the formula -NR<sup>A2</sup>-,  
30       a group represented by the formula -CO-NR<sup>A2</sup>-, or a group represented by the formula -NR<sup>A2</sup>-CO-;

35       A<sup>22</sup> and R<sup>A2</sup> each independently represent a hydrogen atom, a cyano group, a C<sub>1-6</sub> alkyl group, a C<sub>3-8</sub> cycloalkyl group, a C<sub>2-6</sub> alkenyl group, a C<sub>2-6</sub> alkynyl group, a C<sub>6-10</sub> aryl group, a 5- to 10-membered heteroaryl group, a 4- to 8-membered heterocyclic group, a 5- to 10-membered heteroaryl C<sub>1-6</sub> alkyl group, or a C<sub>6-10</sub> aryl C<sub>1-6</sub>

alkyl group;

however,  $A^{22}$  and  $R^{A2}$  each may independently have 1- to 3 substituents selected from the substituent group D described below:

5           <Substituent group D>

Substituent group D represents the group consisting of: a hydroxyl group, a cyano group, a nitro group, a halogen atom, a  $C_{1-6}$  alkyl group, a  $C_{1-6}$  alkoxy group, a  $C_{1-6}$  alkylthio group, a trifluoromethyl group, a group represented by the formula  $-NR^{D1}-R^{D2}$  (where  $R^{D1}$  and  $R^{D2}$  each independently represent a hydrogen atom or a  $C_{1-6}$  alkyl group), a group represented by the formula  $-CO-R^{D3}$  (where  $R^{D3}$  represents a 4 to 8-membered heterocyclic group), and a group represented by the formula  $-CO-R^{D4}-R^{D5}$  (where  $R^{D4}$  represents a single bond, an oxygen atom, or a group represented by the formula  $-NR^{D6}-$ ;  $R^{D5}$  and  $R^{D6}$  each independently represent a hydrogen atom, a  $C_{3-8}$  cycloalkyl group, or a  $C_{1-6}$  alkyl group)).

20. The compound according to any one of claims 1 to 18, or a salt 20 or hydrate thereof,

wherein  $R^2$  represents a hydrogen atom, a cyano group, a carboxy group, a  $C_{2-7}$  alkoxy carbonyl group, a  $C_{1-6}$  alkyl group, a group represented by the formula  $-CONR^{D7}R^{D8}$  (where  $R^{D7}$  and  $R^{D8}$  each independently represent a hydrogen atom or a  $C_{1-6}$  alkyl group), or a group represented by the 25 formula  $-A^{23}-A^{24}$

(where  $A^{23}$  represents an oxygen atom, a sulfur atom or a group represented by the formula  $-NR^{A3}-$ ;

$A^{24}$  and  $R^{A3}$  each independently represent a hydrogen atom, a  $C_{1-6}$  alkyl group which may have a substituent selected from the substituent group D1 described below, a  $C_{3-8}$  cycloalkyl group which may have a substituent selected from the substituent group D1 described below, a  $C_{2-6}$  alkenyl group which may have a substituent selected from the substituent group D1 described below, a  $C_{2-6}$  alkynyl group which may have a substituent selected from the substituent group D1 described below, a phenyl group which may have a substituent selected from the substituent group 35

D1 described below, or a 5 to 10-membered heteroaryl group which may have a substituent selected from the substituent group D1 described below:

5                   <Substituent group D1>

Substituent group D1 represents the group consisting of: a carboxy group, a C<sub>2-7</sub> alkoxycarbonyl group, a C<sub>1-6</sub> alkyl group, a group represented by the formula -CONR<sup>D7</sup>R<sup>D8</sup> (where R<sup>D7</sup> and R<sup>D8</sup> each independently represent a hydrogen atom or C<sub>1-6</sub> alkyl group), a pyrrolidin-1-ylcarbonyl group, a C<sub>1-6</sub> alkyl group, and a C<sub>1-6</sub> alkoxy group).

10                 21. The compound according to any one of claims 1 to 18, or a salt or hydrate thereof,

15                 wherein R<sup>2</sup> represents a hydrogen atom, a cyano group, a C<sub>1-6</sub> alkoxy group, or a group represented by the formula -A<sup>25</sup>-A<sup>26</sup>

20                 (where A<sup>25</sup> represents an oxygen atom, a sulfur atom, or a group represented by the formula -NR<sup>A4</sup>-;

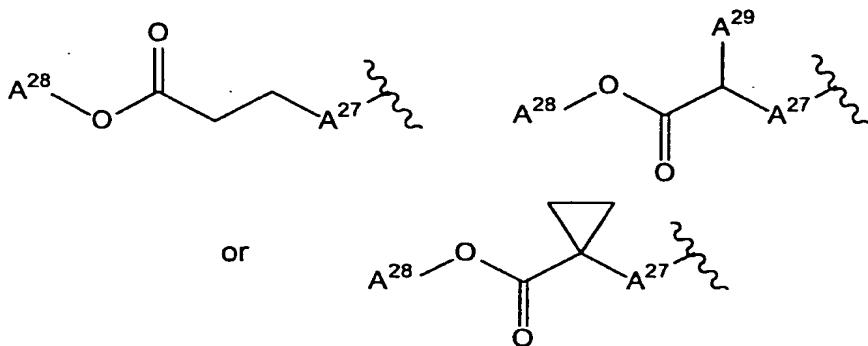
25                 A<sup>26</sup> and R<sup>A4</sup> each independently represent a hydrogen atom, a C<sub>1-6</sub> alkyl group having a substituent selected from the substituent group D1 described below, a C<sub>3-8</sub> cycloalkyl group having a substituent selected from the substituent group D1 described below, or a phenyl group having a substituent selected from the substituent group D1 described below:

30                 <Substituent group D1>

Substituent group D1 represents the group consisting of: a carboxy group, a C<sub>2-7</sub> alkoxycarbonyl group, a C<sub>1-6</sub> alkyl group, a group represented by the formula -CONR<sup>D7</sup>R<sup>D8</sup> (where R<sup>D7</sup> and R<sup>D8</sup> each independently represent a hydrogen atom or a C<sub>1-6</sub> alkyl group), pyrrolidin-1-ylcarbonyl group, a C<sub>1-6</sub> alkyl group, and a C<sub>1-6</sub> alkoxy group).

35                 22. The compound according to any one of claims 1 to 18, or a salt or hydrate thereof,

wherein R<sup>2</sup> is a hydrogen atom, a cyano group, a methoxy group, a carbamoylphenyloxy group, or a group represented by the following formula:



(where  $A^{27}$  represents an oxygen atom, a sulfur atom, or  $-NH-$ ;  
 5  $A^{28}$  and  $A^{29}$  each independently represent a hydrogen atom or a  $C_{1-6}$  alkyl group).

23. The compound according to any one of claims 1 to 18, or a salt or hydrate thereof, wherein  $R^2$  is a hydrogen atom, a cyano group, or  
 10 a 2-carbamoylphenyloxy group.

24. The compound according to claim 1, or a salt or hydrate thereof, wherein the compound of formula (I) indicated above is any one selected from the group consisting of:

15 7-(2-butynyl)-2-cyano-1-methyl-8-(piperazin-1-yl)-1,7-dihydropurin-6-one,  
 3-(2-butynyl)-5-methyl-2-(piperazin-1-yl)-3,5-dihydroimidazo[4,5-d]pyridazin-4-one,  
 2-(3-aminopiperidin-1-yl)-3-(2-butynyl)-5-methyl-3,5-dihydroimidazo[4,5-d]pyridazin-4-one,  
 20 2-[7-(2-butynyl)-1-methyl-6-oxo-8-(piperazin-1-yl)-6,7-dihydro-1H-purin-2-yl]benzamide,  
 7-(2-butynyl)-1-(2-cyanobenzyl)-6-oxo-8-(piperazin-1-yl)-6,7-dihydro-1H-purine-2-carbonitrile, and  
 25 2-[3-(2-butynyl)-4-oxo-2-(piperazin-1-yl)-3,4-dihydroimidazo[4,5-d]pyridazin-5-ylmethyl]benzonitrile.

25. A pharmaceutical agent comprising a compound of claim 1.

26. A dipeptidyl peptidase IV inhibitor comprising a compound of claim 1.

27. A pharmaceutical composition comprising a compound of claim 1 and an adjuvant useful for formulation.

28. A preventive or a therapeutic agent for diabetes mellitus, which comprises a compound of claim 1.

10 29. A preventive or therapeutic agent, which comprises a compound of claim 1, for diabetes mellitus, obesity, hyperlipidemia, AIDS, osteoporosis, a gastrointestinal disorder, angiogenesis, infertility, an inflammatory disease, an allergic disease, or cancer.

15 30. An immunomodulator, a hormone modulator, or an anti-rheumatic drug, which comprises a compound of claim 1.

20 31. A therapeutic or preventive method for a disease in which the inhibition of dipeptidyl peptidase IV is effective, wherein the method comprises administering to a patient a compound of claim 1, or a salt or hydrate thereof, in a pharmaceutically effective amount.

25 32. The use of a compound of claim 1, or a salt or hydrate thereof, in producing a pharmaceutical agent.

33. The use of a compound of claim 1, or a salt or hydrate thereof, in producing a therapeutic or preventive agent for a disease in which the inhibition of dipeptidyl peptidase IV is effective.